



THE SEVENTH INTERNATIONAL CONFERENCE
CIVIL ENGINEERING - SCIENCE & PRACTICE

GNP 2020 PROCEEDINGS



Kolašin, March 2020



UNIVERSITY OF MONTENEGRO



FACULTY OF CIVIL ENGINEERING

**THE SEVENTH INTERNATIONAL CONFERENCE
CIVIL ENGINEERING - SCIENCE & PRACTICE**



GNP 2020 PROCEEDINGS

KOLAŠIN, 10-14 MARCH 2020

ISBN 978-86-82707-32-5

GNP 2020 PROCEEDINGS

- Publisher: **UNIVERSITY OF MONTENEGRO
FACULTY OF CIVIL ENGINEERING**
- For Publisher: **Prof. Marina Rakočević, Dr-Ing.**
- Editors: **Prof. Marina Rakočević, Dr-Ing.
Assoc. Prof. Biljana Šćepanović, Dr-Ing.**
- Editorial board: **Prof. Marina Rakočević, Dr-Ing.
Prof. Miloš Knežević, Dr-Ing.
Assoc. Prof. Biljana Šćepanović, Dr-Ing.
Assoc. Prof. Olga Mijušković, Dr-Ing.
Ivana Ćipranić, Dr-Ing.
Marija Jevrić, Dr-Ing.
Mladen Gogić, MSc, Dipl. Ing.
Boris Jevrić, Dipl. Ing.**
- Technical editor: **Boris Jevrić, Dipl. Ing.**
- Number of copies: **300**

CIP - Каталогизacija y публикацији
Национална библиотека Црне Горе, Цетиње

ISBN 978-86-82707-32-5
COBISS.CG-ID 40381456

ISBN 978-86-82707-32-5



9 788682 707325 >



GNP 2020 SPONSORS

Gold Sponsor

CHINA ROAD AND BRIDGE CORPORATION, Podgorica, Montenegro

Silver Sponsor

SIKA SRBIJA, Šimanovci, Serbia

Bronze Sponsors

CEMEX MONTENEGRO, Podgorica, Montenegro

INSTITUT ZA GRAĐEVINARSTVO, Podgorica, Montenegro

FRAGMAT, Danilovgrad, Montenegro

MUREXIN, Zagreb, Croatia

REGIONAL WATERWORKS FOR THE MONTENEGRIN COAST, Budva, Montenegro

STRABAG, Podgorica, Montenegro

GNP 2020 SPONSORS

Friends of the Conference

ADING, Skopje, North Macedonia
AZMONT INVESTMENTS, Herceg Novi, Montenegro
BEMAX, Podgorica, Montenegro
CG RAD, Podgorica, Montenegro
FONDACIJA PROFESOR ARSENIJE VUJOVIĆ, Podgorica, Montenegro
GEOPROJEKT, Podgorica, Montenegro
GRAĐEVINSKI INSTITUT MONTENEGRO, Podgorica, Montenegro
MONTEPUT – PJ AUTOPUT BAR-BOLJARE, Podgorica, Montenegro
M SOLUTIONS, Podgorica, Montenegro
RG GROUP, Podgorica, Montenegro
SAVA OSIGURANJE, Podgorica, Montenegro
TD RADING, Skopje, North Macedonia
TENSAR INTERNATIONAL, Český Těšín, Czech Republic
TKK Srpenica, Slovenia
VIGORIS ECOTECH, Podgorica, Montenegro

Donors

AGENCY FOR ELECTRONIC COMMUNICATIONS AND POSTAL SERVICES,
Podgorica, Montenegro
DECOM MONTENEGRO, Podgorica, Montenegro
ETG GRUPA, Podgorica, Montenegro
GEOPROM, Podgorica, Montenegro
INSTITUTE FOR STANDARDIZATION OF MONTENEGRO
MINISTRY OF SCIENCE, Montenegro
MINISTRY OF SUSTAINABLE DEVELOPMENT AND TOURISM, Montenegro
MUNICIPALITY OF KOLAŠIN, Montenegro
MUNICIPALITY OF KOTOR, Montenegro
NATIONAL TOURISM ORGANISATION OF MONTENEGRO
NIK COM, Nikšić, Montenegro
ROCKLER INŽENJERING, Budva, Montenegro
VODOVOD I KANALIZACIJA, Podgorica, Montenegro

GNP 2020 Scientific Committee

Assoc. Prof. Dr Srđa Aleksić, University of Montenegro, Podgorica, Montenegro
Prof. Dr Miroslav Bešević, University of Novi Sad, FCE Subotica, Subotica, Serbia
Professor Emerita Dubravka Bjegović, University of Zagreb, Zagreb, Croatia
Prof. Dr Vuk Bogdanović, University of Novi Sad, FTS, Novi Sad, Serbia
Prof. Dr Branko Božić, University of Belgrade, Belgrade, Serbia
Prof. Dr Stanko Brčić, University of Belgrade, Belgrade, Serbia
Prof. Dr Paulo Barreto Cachim, University of Aveiro, Aveiro, Portugal
Prof. Dr Cristina Câmpian, Technical University of Cluj-Napoca, Cluj-Napoca, Romania
Prof. Dr Cornel Cismasiu, University NOVA, Lisbon, Portugal
Prof. Dr Ildi Cismasiu, University NOVA, Lisbon, Portugal
Prof. Dr Anca Constantin, Ovidius University of Constanta, Constanta, Romania
Prof. Dr Meri Cvetkovska, Ss. Cyril and Methodius University, FCE, Skopje, North Macedonia
Assoc. Prof. Dr Szymon Dawczyński, Silesian University of Technology, Gliwice, Poland
Prof. Dr Samir Dolarević, University of Sarajevo, Sarajevo, Bosnia and Herzegovina
Prof. Dr Velimir Dutina, University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica
Prof. Dr Nebojša Đuranović, University of Montenegro, Podgorica, Montenegro
Assist. Prof. Dr Radovan Đurović, University of Montenegro, Podgorica, Montenegro
Professor Emeritus Radomir Folić, University of Novi Sad, FTS, Novi Sad, Serbia
Prof. Dr Luisa María Gil Martín, University of Granada, Granada, Spain
Assoc. Prof. Dr Branislav Glavatović, University of Montenegro, Podgorica, Montenegro
Assoc. Prof. Dr Marcin Górski, Silesian University of Technology, Gliwice, Poland
Prof. Dr Emina Hadžić, University of Sarajevo, Sarajevo, Bosnia and Herzegovina
Assoc. Prof. Dr Tomáš Hanák, Brno University of Technology, Brno, Czech Republic
Prof. Dr Wei Hao, Changsha University of Science and Technology, Changsha, China
Assoc. Prof. Dr Maria Mavrova-Guirginova,
University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria
Prof. Dr Enrique Hernández Montes, University of Granada, Granada, Spain
Dr Micha Horacek, BLT Wieselburg, HBLFA Francisco Josephinum, Vienna, Austria
Prof. Dr Adrian Ioani, Technical University of Cluj-Napoca, Cluj-Napoca, Romania
Prof. Dr Nenad Ivanišević, University of Belgrade, Belgrade, Serbia
Assist. Prof. Dr Biljana Ivanović, University of Montenegro, Podgorica, Montenegro
Assoc. Prof. Dr Nikša Jajac, University of Split, Split, Croatia
Prof. Dr Srđan Janković, University of Montenegro, Podgorica, Montenegro
Prof. Dr Milorad Jovanovski, Ss. Cyril and Methodius University, FCE, Skopje, North Macedonia
Prof. Dr Miloš Knežević, University of Montenegro, Podgorica, Montenegro
Assist. Prof. Dr Tatjana Kočetov Mišulić, University of Novi Sad, FTS, Novi Sad, Serbia
Assist. Prof. Dr Janusz Witalis Kozubal, Wrocław University of Technology, Wrocław, Poland
Prof. Dr Vladan Kuzmanović, University of Belgrade, Belgrade, Serbia
Prof. Dr Đorđe Lađinović, University of Novi Sad, FTS, Novi Sad, Serbia
Prof. Dr Duško Lučić, University of Montenegro, Podgorica, Montenegro
Prof. Dr Carmen Maștei, Transilvania University of Braşov, Braşov, Romania
Prof. Dr Mirjana Malešev, University of Novi Sad, FTS, Novi Sad, Serbia
Assoc. Prof. Dr Ljubo Marković, University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica
Prof. Dr Matjaž Mikoš, University of Ljubljana, Ljubljana, Slovenia

Assoc. Prof. Dr Brankica Milojević,
University of Banja Luka, Banja Luka, Bosnia and Herzegovina

Prof. Dr Nicola Nistico, Sapienza University of Rome, Rome, Italy

Prof. Dr Hartmut Pasternak, Brandenburg University of Technology, Cottbus, Germany

Prof. Dr Radenko Pejović, University of Montenegro, Podgorica, Montenegro

Prof. Dr Živojin Prašćević, University of Belgrade, Belgrade, Serbia

Prof. Dr Miroslav Premrov, University of Maribor, Maribor, Slovenia

Assoc. Prof. Dr Maja Prskalo, University of Mostar, Mostar, Bosnia and Herzegovina

Prof. Dr Vlastimir Radonjanin, University of Novi Sad, FTS, Novi Sad, Serbia

Assist. Prof. Dr Željka Radovanović, University of Montenegro, Podgorica, Montenegro

Assoc. Prof. Dr Milan Radulović, University of Montenegro, Podgorica, Montenegro

Prof. Dr Marina Rakočević, University of Montenegro, Podgorica, Montenegro

Assoc. Prof. Dr Aleksandar Ristovski, University of Priština, Faculty of Technical Sciences
in Kosovska Mitrovica

Prof. Dr Maria Fernanda de Silva Rodrigues, University of Aveiro, Aveiro, Portugal

Assist. Prof. Dr Snežana Rutešić, University of Montenegro, Podgorica, Montenegro

Prof. Dr Todorka Samarđžioska,
Ss. Cyril and Methodius University, FCE, Skopje, North Macedonia

Prof. Dr Goran Sekulić, University of Montenegro, Podgorica, Montenegro

Assoc. Prof. Dr Vlatko Sheshov,
Ss. Cyril and Methodius University, IZIIS, Skopje, North Macedonia

Assoc. Prof. Dr Radmila Sinđić Grebović, University of Montenegro, Podgorica, Montenegro

Prof. Dr Zlatko Srbinoski,
Ss. Cyril and Methodius University, FCE, Skopje, North Macedonia

Prof. Dr Milenko Stanković, University of Banja Luka, Banja Luka, Bosnia and Herzegovina

Prof. Dr Boško Stevanović, University of Belgrade, Belgrade, Serbia

Assoc. Prof. Dr Merima Šahinagić-Isović,
University Džemal Bijedić, Mostar, Bosnia and Herzegovina

Assoc. Prof. Dr Biljana Šćepanović, University of Montenegro, Podgorica, Montenegro

Prof. Dr Andrej Šoltész, Slovak University of Technology, Bratislava, Slovakia

Assoc. Prof. Dr Suad Špago, University Džemal Bijedić, Mostar, Bosnia and Herzegovina

Assoc. Prof. Dr Ivana Štimac-Grandić, University of Rijeka, Rijeka, Croatia

Prof. Dr Zvonko Tomanović, University of Montenegro, Podgorica, Montenegro

Prof. Dr Slaviša Trajković, University of Niš, Niš, Serbia

Prof. Dr Milan Trivunić, University of Novi Sad, FTS, Novi Sad, Serbia

Prof. Dr Mladen Ulićević, University of Montenegro, Podgorica, Montenegro

Assoc. Prof. Dr Damir Varevac, Josip Juraj Strossmayer University, Osijek, Croatia

Prof. Dr Milan Veljković, Delft University of Technology, Delft, The Netherlands

Prof. Dr Dušan Vuksanović, University of Montenegro, Podgorica, Montenegro

Prof. Dr Guoxin Wang, Dalian University of Technology, Dalian, China

Assoc. Prof. Dr Zlatko Zafirovski,
Ss. Cyril and Methodius University, FCE, Skopje, North Macedonia

Prof. Dr Radomir Zejak, University of Montenegro, Podgorica, Montenegro

Assoc. Prof. Dr Vesna Žegarac Leskovar, University of Maribor, Maribor, Slovenia

Assoc. Prof. Dr Ljiljana Žugić, University of Montenegro, Podgorica, Montenegro

GNP 2020 Organising Committee

*University of Montenegro
Faculty of Civil Engineering*

*NGO “Građevinarstvo – nauka i praksa – GNP”
Podgorica, Montenegro*

Prof. Marina Rakočević, Dr.-Ing.

Prof. Miloš Knežević, Dr.-Ing.

Assoc. Prof. Biljana Šćepanović, Dr.-Ing.

Assoc. Prof. Olga Mijušković, Dr.-Ing.

Ivana Čipranić, Dr.-Ing.

Marija Jevrić, Dr.-Ing.

Mladen Gogić, MSc

Maja Laušević Odalović, MSc

Mladen Muhadinović, MSc

Miodrag Bujišić, MSc

Petar Subotić, Spec. Sci.

Ivana Drobnjak, Spec. Sci.

THE FOREWORD

We broaden the building culture again. Now, the seventh time, in wonderful Kolašin. We have gathered about various topics, but always related, coming from the unified effort: to understand the creative process of building, to exchange ideas, to meet in positive atmosphere.

Like each time, this conference brings us contemporary trends of spiritual and material culture of building. In period when our public morality is offended in media, in urban development, in investments, we must spread the building culture by the power of our mind. It is an imperative because of dignity of ourselves and generations coming after us.

Horizons of GNP 2020 consist of 136 papers written by 338 authors from 24 countries.

We are grateful to papers' authors, to Scientific Committee members and particularly to sponsors and friends, representatives of foreign and Montenegrin companies and institutions who supported us in organisation and helped realisation of GNP 2020 conference.

Podgorica, March 2020

GNP 2020 ORGANISING COMMITTEE



**7TH INTERNATIONAL CONFERENCE
CIVIL ENGINEERING - SCIENCE AND PRACTICE**

KOLAŠIN, 10-14 MARCH 2020

TABLE OF CONTENTS

INVITED LECTURES 1

Radomir Folić, Miloš Čokić

**FRAGILITY ANALYSIS OF A BUILDING WITH DIFFERENT STRUCTURAL
SYSTEMS, IN TWO ORTHOGONAL DIRECTIONS, WITH APPLICATION OF
NONLINEAR DYNAMIC ANALYSIS 3**

Nicola Nisticò

**FIBER REINFORCED POLYMER MATERIALS FOR STRUCTURAL
APPLICATIONS 21**

Hartmut Pasternak, Thomas Krausche

**DESIGN, CONSTRUCTION AND ASSEMBLY OF TWO
MEMBRANE-CLADDED DOUBLE-CURVED NET ROOFS 45**

**THEORETICAL AND EXPERIMENTAL
RESEARCH IN CIVIL ENGINEERING 53**

Aleksandar Čeranić, Saša Kovačević, Nenad Marković

**INFLUENCE OF PATCH LOAD LENGTH AND FLANGE STIFFNESS ON THE
ULTIMATE STRENGTH OF STEEL PLATE GIRDERS 55**

Aleksandra Čilić, Danijela Đurić-Mijović, Jelena Savić, Danijela Milanović

**STRUCTURAL DESIGN OF MULTI-STOREY STEEL BUILDINGS
CONSIDERING SHEAR WALLS AND FLOOR SLABS 63**

<i>Mirjana Đukić, Zlatko Marković, Duško Lučić</i> ASYMMETRIC COMPOSITE SLIM FLOOR BEAMS WITH WEB OPENINGS – OVERVIEW OF RESEARCH	71
<i>Luisa María Gil-Martín, Enrique Hernández-Montes</i> INFLUENCE OF THE LEVER ARM IN THE STRENGTH DESIGN OF RC SLABS ...	79
<i>Igor Gjorgjiev, Borjan Petreski</i> THE EFFECT OF THE DIFFERENCE BETWEEN THE DESIGNED AND BUILT-IN REINFORCING STEEL	87
<i>Armin Hadrović, Mili Selimotić, Goran Simonović, Đani Rahimić</i> CONVERGENCE OF THE 3D FINITE ELEMENT METHOD WITH VARIABLE ... ELEMENT TOPOLOGY (VETFEM)	95
<i>Andrej Ivanič, Gregor Kravanja, Samo Lubej</i> FLEXURAL STRENGTHENING OF THIN CONCRETE MEMBERS USING CONTINUOUS HEMP FIBERS	103
<i>Marija Jevrić, Ivana Čipranić, Nataša Kopitović-Vuković</i> FRACTALS IN CIVIL ENGINEERING	111
<i>Milica Jovanoska, Todorka Samardžioska, Vesna Grujoska</i> MODELLING CLASSROOM ACOUSTICS USING IN SITU MEASUREMENTS ..	119
<i>Stojan Kravanja, Tomaž Žula, Primož Jelušič</i> MINLP APPROACH TO THE OPTIMIZATION OF STRUCTURES	127
<i>Aliz Mathe, Ilinca-Florina Moldovan</i> A STUDY ON THE SEMI-RIGIDITY OF STEEL FRAMES PLACED IN SEISMIC AREAS	135
<i>Ognjen Mijatović, Zoran Mišković, Ratko Salatić, Rastislav Mandić, Valentina Golubović - Bugarski</i> A NUMERICAL VERIFICATION OF IPE-80 STEEL CANTILEVER BEAM WITH BOLTED AND WELDED SPLICE CONNECTION JOINT	141
<i>Olga Mijušković, Biljana Šćepanović, Ljiljana Žugić</i> COMPARATIVE ANALYSIS OF TWO ANALYTICAL MODELS FOR BUCKLING PROBLEMS OF PLATES UNDER PATCH LOAD	149
<i>Olga Mijušković, Ljiljana Žugić, Biljana Šćepanović</i> CONVERGENCE ANALYSIS OF ANALYTICAL APPROACH FOR STABILITY PROBLEMS REGARDING NUMBER OF TERMS IN DEFLECTION FUNCTION	157
<i>Ashkan Shoushtarian Mofrad, Darita Shlychkova, Yvonne Ciupack, Hartmut Pasternak</i> STUDY OF BENDING, TRANSLATIONAL AND TORSIONAL STIFFNESS OF SANDWICH PANELS IN FIRE	165
<i>Maria Pop, Cristina Campian, Nicolae Chira</i> NUMERICAL STUDY OF STEEL-CONCRETE COMPOSITE COLUMNS WITH HIGH STRENGTH CONCRETE	173

<i>Svetislav Popović, Marina Rakočević</i>	
EFFECTIVE NOTCH STRESS METHOD FOR FATIGUE EVALUATION OF VORTEX EXCITED HYBRID TOWER	179
<i>Miroslav Premrov, Andrej Štrukelj, Gregor Finžgar, Boštjan Ber</i>	
PARAMETRIC STUDY ON RACKING RESISTANCE OF TIMBER-GLASS PREFABRICATED WALL ELEMENTS	187
<i>Aleksandra Radujković, Đorđe Lađinović</i>	
PERFORMANCE EVALUATION OF RC COLUMN UNDER MONOTONIC LOAD	195
<i>Marina Rakočević, Ivana Drobnjak, Ivan Mrdak</i>	
NUMERICAL MODELS FOR WALLS UNDER IN-PLANE LOADS	203
<i>Andrija Rašeta, Anka Starčev-Čurčin, Igor Džolev, Miloš Šešlija, Danijel Kukaras</i>	
ASSESSMENT OF RC FRAME NONLINEAR BEHAVIOR BY CDP MODEL APPLICATION	211
<i>Milivoje Rogač, Srđa Aleksić</i>	
INFLUENCE OF INITIAL IMPERFECTIONS ON ULTIMATE STRENGTH OF PATCH-LOADED PLATE GIRDERS	221
<i>Mili Selimotić, Armin Hadrović, Đani Rahimić</i>	
SHAPE FUNCTIONS FOR A FINITE ELEMENT METHOD WITH POLYHEDRAL ELEMENT GEOMETRY	229
<i>Mili Selimotić, Armin Hadrović, Đani Rahimić</i>	
NUMERICAL INTEGRATION FOR A FINITE ELEMENT METHOD WITH POLYHEDRAL ELEMENT GEOMETRY	235
<i>Florian Sternsdorff, Yvonne Ciupack, Emre Mehmet Yilmaz, Hartmut Pasternak, Ioannis Vayas</i>	
INVESTIGATIONS ON BEAM-TO-COLUMN CONNECTIONS REINFORCED WITH ADHESIVELY BONDED CFRP LAMELLAS	241
<i>Petar Subotić, Mladen Muhadinović, Đorđe Đuričić, Duško Lučić</i>	
CLASS 3 OR SEMI COMPACT CROSS SECTION	249
<i>Ionuț-Ovidiu Toma, Areej Younis, Fideliu Păuleț-Crăiniceanu, Octavian-Victor Roșca, Ioana Olteanu-Donțov, Mircea-Vasile Venghiac, Ana-Maria Toma</i>	
ASSESSING THE SEISMIC BEHAVIOR OF A REINFORCED CONCRETE FRAME STRUCTURE BY MEANS OF SHAKE TABLE TESTS	257
<i>Ljiljana Žugić, Stanko Brčić, Olga Mijušković, Biljana Šćepanović</i>	
FREE VIBRATION ANALYSIS OF SPATIAL FRAMES BY COMPUTER CODE ALIN	265
<i>Tomaž Žula, Stojan Kravanja, Primož Jelušič</i>	
OPTIMIZATION OF A PITCHED ROOF STEEL BUILDING	273

DESIGN AND BUILDING OF STRUCTURES 281

Yuesen Feng, Yichen Gao, Junchang Zheng

**DEVELOPMENT AND APPLICATION ON BRIDGE INDUSTRIALIZATION
TECHNOLOGY 283**

*Manuel Alejandro Fernández-Ruiz, Anastasiia Moskaleva, Luisa María Gil-Martín,
Enrique Hernández-Montes*

**DESIGN OF A COMPRESSION STRUCTURE WITH PRESTRESSING
TENDONS INSPIRED BY THE TWA FLIGHT CENTER 295**

Lorens Gobo

INSTALLATION OF LARGE FORMAT CERAMIC TILES 303

Darko Kasica

TECHNOLOGY OF POST TENSIONING “MORAČICA” BRIDGE 309

Duško Lučić, Teodora Bulatović, Ivana Tešović, Milena Janković, Mladen Muhadinović

STEEL ROOF STRUCTURE FOR FOOTBALL STADIUM IN NIKŠIĆ 315

*Duško Lučić, Ivana Tešović, Miloš Vučinić, Teodora Bulatović, Milena Janković,
Mladen Muhadinović, Slavica Dopuđa, Nikola Luković, Predrag Koprivica,
Svetlana Kastratović, Ivan Gorašević, Vladimir Božović*

DESIGN AND EXECUTION OF WAREHOUSE IN BAR 323

Milan Marojević

TOP-DOWN CONSTRUCTION METHOD 331

*Radenko Pejović, Ivana Tešović, Teodora Bulatović, Olga Luković, Zdenko Dvornik,
Danilo Kovačević*

**CONSTRUCTION OF THE RO-RO RAMP AS A PART OF RECONSTRUCTION
OF THE JETTY NO 1 AT PORT OF BAR, MONTENEGRO 337**

Predrag Presecki, Milan Kuhta, Dejan Buha

CONGRESS HALL PT SLABS OF LONG SPAN 345

Željka Radovanović

SOME ASPECT OF BRIDGES DURATION IN EUROCODES 353

Goran Simonović, Jelena Medić, Senad Medić, Mili Selimotić

PROBLEM OF OPENING IN A CYLINDRICAL SILO 361

ASEISMIC PLANNING, DESIGN AND BUILDING 369

Vasilije Bojović, Nikola Bjeletić

**THE EFFECT OF GROUND CATEGORY ON RC FRAME STRUCTURE
SEISMIC PERFORMANCE 371**

<i>Živko P. Cuckić</i>	
AN INNOVATIVE PREFABRICATED BUILDING SYSTEM FOR THE SEISMIC REGIONS	379
<i>Elena Delova, Zivko Bozinovski, Aleksandar Zlateski</i>	
VULNERABILITY OF MODERN RC HIGH-RISES WITH SYSTEM FLAWS IN DESIGN AND CONSTRUCTION – EXPERIENCE FROM THE EARTHQUAKE THAT HIT DURRES IN ALBANIA	387
<i>Jasmina Dražić</i>	
ADJUSTED ASEISMIC DESIGN	395
<i>Zlatko Džanić, Mustafa Hrasnica, Senad Medić, Fadil Biberkić</i>	
SEISMIC PERFORMANCE OF LARGE LIGHTLY REINFORCED WALLS	403
<i>Zlatko Džanić, Mustafa Hrasnica, Senad Medić, Fadil Biberkić</i>	
OPTIMIZED BEHAVIOUR OF VERTICALLY IRREGULAR FRAMES UNDER SEISMIC LOAD	411
<i>Kefajet Edip, Radmila Salic, Hristina Ristovska</i>	
COMPARATIVE REVIEW OF CURRENT EARTHQUAKE DAMAGE ASSESSMENT METHODOLOGY IN N. MACEDONIA AND UNITED STATES OF AMERICA (ATC-20)	419
<i>Danilo Milošević</i>	
MODELLING AND COMPARATIVE ANALYSIS OF SIX STORY BUILDING WITH BASE ISOLATION	429
<i>Jelena Ristic</i>	
NONLINEAR SEISMIC BEHAVIOR STUDY OF NEWLY DESIGNED RESIDENTIAL BUILDING	437
<i>Nina Serdar, Jelena Pejović</i>	
INFLUENCE OF ABUTMENT MODEL ON RESULTS OF BRIDGE PUSHOVER ANALYSIS	447
<i>Kenan Strujić, Ivan Mrdak, Marina Rakočević</i>	
ANALYSIS OF DIFFERENT MODELS FOR STRUCTURAL SYSTEM WITH COUPLED WALLS ACCORDING TO NATIONAL REGULATIONS AND EUROCODES	455
<i>Marija Vitanova, Vlatko Sesov, Barbara Borzi, Ricardo Monteiro, Andres Abarca, Radmila Salic, Kemal Edip, Gerard O'Reilly, Elisa Zucollo</i>	
IDENTIFICATION OF CRITICAL INFRASTRUCTURE NODES AND OPTIMISATION OF RESOURCES USING INFRA-NAT WEB BASED PLATFORM	463
<i>Ljiljana Žugić, Stanko Brčić, Olga Mijušković, Biljana Šćepanović</i>	
INFLUENCE OF DILATATION GAP ON SEISMIC RESPONSE OF TWO ADJACENT NON-SYMMETRIC MULTISTORY BUILDINGS	473

SPECIAL ISSUES OF DESIGN AND CONSTRUCTION 481

- Armin Hadrović, Mili Selimotić, Ismet Hajduk*
TEMPERATURE ACTIONS FOR TIME HISTORY THERMO-STRESS ANALYSIS OF THE JABLANICA DAM 483
- Biljana Lovčević Kureljušić, Stanko Pavlović, Mirjana Laban, Anka Starčev-Čurčin, Igor Peško*
PLAN OF PREVENTIVE MEASURES FOR THE PURPOSES OF EXECUTING WORKS IN INDUSTRIAL AND ENERGY PLANTS PLAN 491
- Dragan Lukic, Aleksandar Prokic*
GROUND FREEZING METHOD 501
- Ljubo Marković, Ljiljana Milić Marković, Velimir Dutina, Aleksandar Mićović*
FIRE PROTECTION MEASURES FOR PROJECT OF PODGORICA RAILWAY STATION SIGNALLING REPLACEMENT 509
- Đani Rahimić, Mili Selimotić*
DESIGN AND CONSTRUCTION OF VIA FERRATAS 517

BUILDING MATERIALS 525

- Vedran Carević, Ivan Ignjatović*
INFLUENCE OF CRACKS ON CONCRETE CARBONATION RESISTANCE 527
- Szymon Dawczyński, Anita Węclawik*
PRELIMINARY RESEARCH ON THE CURING TEMPERATURE IMPACT ON STRENGTH PARAMETERS OF THE GEOPOLYMER BASED ON TUNGSTEN MINE WASTE 535
- Vesna Grujoska, Jasna Grujoska, Todorka Samardžioska, Milica Jovanoska*
WASTE GLASS EFFECTS ON FRESH AND HARDENED CONCRETE 543
- Ksenija Janković, Dragan Bojović, Marko Stojanović, Iva Despotović, Lana Antić Arandelović*
USE OF IRON ORE TAILINGS FOR PRODUCTION OF CONCRETE PAVING BLOCKS 551
- Nataša Koptović-Vuković, Radomir Zejak, Marija Jevrić, Nikola Baša*
RHEOLOGICAL MODEL OF FRP REINFORCED CONCRETE 557
- Rita-Cristina Pišta, Ionuț-Ovidiu Toma, Mihaela Ibănescu, Oana-Mihaela Banu, Gabriela Covatariu, Ana-Maria Toma, Cerasela-Panseluța Olariu*
LONG TERM DYNAMIC CHARACTERISATION OF MORTARS WITH DIFFERENT PERCENTAGES OF ENVIRONMENTALLY SUSTAINABLE BINDER 565
- Goce Prangovski, Georgi Goshev, Goran Gjosevski, Milica Radulovic*
WASTE GLASS FROM CRT MONITORS, AS REPLACEMENT FOR AGGREGATE IN THE CONCRETE 573

<i>Željka Radovanović, Katarina Mirković</i> POSSIBILITIES OF USING FLY ASH FROM TPP „PLJEVLJA“ IN COMPOSITE MORTARS	583
<i>Todorica Samardžioska, Vesna Grujoska, Sead Abazi</i> TESTING THERMAL CONDUCTIVITY OF A LIQUID COATING – WATER BASED ACRYLIC MIXTURE	591
<i>Tijana Stevanović, Marija Todorović, Boško Stevanović, Ivan Glišović</i> BUILDING WITH WOOD IN 21ST CENTURY: CONTEMPORARY BUILDING WOOD PRODUCTS	599
<i>Marko Stojanović, Dragan Bojović, Ksenija Janković, Lana Antić Arandžević</i> THE INFLUENCE OF TWO TYPES OF POLYPROPYLENE FIBRES ON THE MECHANICAL PROPERTIES OF SHOTCRETE	607
<i>Milica V. Vasić, Miodrag Mitrić, Zagorka Radojević</i> CHARACTERIZATION AND UTILIZATION POTENTIAL OF CERAMIC CLAYS FROM SERBIA	613
MAINTENANCE AND REPAIR OF STRUCTURES	621
<i>Željka Beljkaš, Miloš Knežević, Radenko Pejović, Nevena Šipčić, Marko Knežević</i> GUIDELINES FOR THE DEVELOPMENT OF THE FINAL RECONSTRUCTION DESIGN WITH THE PROPOSAL OF A SOLUTION FOR THE REHABILITATION AND EXECUTION OF WORKS AT THE UNSANITARY LANDFILL ČAFE, LOCATED IN DOBRE VODE, BAR	623
<i>Miloš Knežević, Ivana Tešović, Kemal Abdić, Kostantin Dragović, Zlatko Zafirovski, Đorđina Lovrić, Slobodan Dakić, Goran Pavlović, Marko Knežević, Anđela Knežević</i> REHABILITATION OF THE RAILWAY SECTION „KOS-TREBEŠICA“ IN MONTENEGRO	631
<i>Tatjana Kočetov Mišulić, Dragan Manojlović</i> PRELIMINARY ASSESSMENT OF EXISTING LARGE-SPAN GLUED LAMINATED TIMBER STRUCTURE	639
<i>Radenko Pejović, Jelena Pejović, Vlastimir Prašćević, Nadežda Bojić</i> REHABILITATION OF THE EXISTING RC DECK ARCH BRIDGE MELJEŠTAK ON THE MAIN ROAD PODGORICA – KOLAŠIN	647
<i>Marina Poposka, Goran Chapragoski, Aleksandar Zhurovski, Elena Delova, Zivko Bozhinovski, Dragi Dojchinovski</i> VISUAL INSPECTION AND DAMAGE IDENTIFICATION FOR “TISOVEC” TUNNEL	655
<i>Nikola Postolov, Riste Volchev, Koce Todorov, Meri Cvetkovska</i> SAFETY CONTROL AND REHABILITATION MEASURES FOR CONCRETE SLAB FOUNDATION	663

<i>Jelena Savić, Danijela Milanović, Aleksandra Cilić, Danijela Đurić-Mijović</i> MASONRY BUILDINGS DAMAGE: CAUSES AND CLASSIFICATION	673
<i>Dragan Stamev, Siljan Mihajlovski, Anita Kilibarda Krulanovic, Zoran Dinov</i> REHABILITATION AND STRENGTHENING OF RC CONSTRUCTION ON OPERATING COAST “VOLUJICA” LUKA BAR – BAR	681
<i>Boško Stevanović, Mihailo Muravljov, Drago Ostojić, Ivan Glišović, Marija Todorović</i> REHABILITATION OF ARCH BRIDGE ACROSS LEPNICA RIVER IN KRAGUJEVAC	691
<i>Milan Trivunić, Željko Jakšić, Slobodan Kolaković, Ivan Lukić, Dušanka Plazina Pevač</i> THE USE OF DRONS IN MULTY-STOREY BUILDINGS’ MAINTENANCE	701
MONITORING OF STRUCTURES DURING CONSTRUCTION AND EXPLOITATION	709
<i>Zoran Mišković, Marina Latinović, Marko Popović, Siniša Savatović</i> MODAL PROPERTIES OF THE OLD SUSPENSION FOOTBRIDGE BASED ON AMBIENT VIBRATION MEASUREMENTS	711
<i>André Monteiro, Pedro Costa, Markus Oeser, Paulo Cachim</i> A MULTIFUNCTIONAL CEMENT COMPOSITE WITH CARBON BLACK FOR TRAFFIC MONITORING	719
<i>Dragan Nikolić, Dragan Bojović, Lana Antić-Arandelović, Goran Ćirović</i> ULTRASONIC TOMOGRAPHY AND GROUND PENETRATING RADAR USED IN CONCRETE EVALUATION	727
<i>Željka Radovanović</i> MONTENEGRO NEEDS BRIDGE MANAGEMENT SYSTEM	735
<i>Arta Sylejmani, Bojan Milovanovic</i> BUILDING DIAGNOSTIC THROUGH INFRARED THERMOGRAPHY IMAGES ...	743
BUILDING REGULATIONS AND CODES	755
<i>Cristina Campian, Maria Pop, Nicolae Chira</i> SOME CONSIDERATIONS ON THE EVOLUTION OF THE STANDARDS OF CALCULATION OF THE COLUMNS WITH THE COMPOSITE STEEL-CONCRETE SECTION	757
<i>Sonja Cerepnalkovska, Meri Cvetkovska</i> THE LINK BETWEEN MANUFACTURER AND REGULATORY REQUIREMENTS ON CONSTRUCTION PRODUCT	767
<i>Jug Drobac, Ivana Štimac Grandić</i> COMPARISON OF VERTICAL BRIDGE ACCELERATION ACCORDING TO UK NA 1992-1 AND ANNEX B TO EN 1995-2	775

Miloš Knežević, Nadežda Lučić, Marko Knežević

**CERTIFICATION OF FACTORY PRODUCTION CONTROL OF CONCRETE
AGGREGATES IN ACCORDANCE WITH MEST EN 12620:2015 783**

Danica Vukajlovic, Vladimir Mucenski

**COMPARATIVE ANALYSIS OF THE DEFINITION OF THE LAW AND
SECTOR OF CRITICAL INFRASTRUCTURE IN THE REPUBLIC OF
SERBIA AND FOREIGN COUNTRIES 791**

PLANNING, DESIGN AND CONSTRUCTION OF ROADS AND RAILWAYS 799

Kenan Kajošević

**PRODUCTION OF THE MIXTURE FOR THE BAR - BOLJARE
(SMOKOVAC-MATESEVO SECTION) HIGHWAY ASPHALT 801**

*Zlatko Zafirovski, Slobodan Ognjenovic, Vasko Gacevski, Ivona Nedevska,
Ivana Nedevska*

LEVEL CROSSINGS AT RAILWAYS 809

SPATIAL, ARCHITECTURAL AND URBAN PLANNING AND DESIGN 817

Julija Aleksić, Mirjana Miletić, Rada Radulović, Jelena Božović

CONTAINERIZATION: REALITY OR VISION OF NEW AGE 819

Sokol Dervishi, Luljeta Spahiu, Dorela Sina

**PASSIVE DESIGN STRATEGIES OF VERNACULAR ARCHITECTURE:
A CASE STUDY OF GJIROKASTRA 827**

Mirjana Laban, Suzana Draganić, Vlastimir Radonjanin, Olivera Bukvić

**PREFABRICATED RESIDENTIAL BUILDINGS FROM THE STATE
SOCIALIZM ERA IN HUNGARY, ROMANIA AND SERBIA 835**

Strahinja Trpevski

**PLANNING OF DEVELOPMENT TECHNOLOGY PARK ON A CASE IN
THE NORTHEAST REGION IN REPUBLIC OF NORTH MACEDONIA 845**

ENVIRONMENTAL PROTECTION 853

*Dubravka Bjegović, Ivana Banjad Pečur, Nina Štirmer, Ana Baričević, Marijana Serdar,
Ivana Carević, Marina Bagarić*

**INNOVATIVE CONSTRUCTION PRODUCTS: DRIVERS OF SUSTAINABLE
ENGINEERING 855**

Büşra Cesur, Cristina Campian

EVALUATION OF FLOATING STRUCTURES IN TERMS OF SUSTAINABLE AND EFFECTIVE ENERGY USES 865

Ivana Čipranić, Marija Jevrić, Goran Sekulić, Rajko Janjić, Nikola Čipranić

REMEDIATION OF THE MINE TAILINGS DISPOSAL FACILITY GRADAC–MONTENEGRO 875

HYDROTECHNICS 883

Olivera Dokleštic

REDUCING WATER LOSSES ON THE NETWORK BY INCREASING THE DEGREE OF OPERATION ON FAILURE REPAIR 885

Goran Jeftenić, Slobodan Kolaković, Danilo Stipić, Srđan Kolaković, Ljubomir Budinski, Miloš Šešlija

USING HYDRAULIC MODELING IN AN OPEN CHANNEL FLOW AND VARIOUS RESTRICTIONS BASE ON IRON GATE CANYON, DANUBE SECTION KM 1116.2 – 943.0 893

Mirjana Laban, Marko Marković, Mirjana Malešev, Olivera Bukvić

WATER AND THE CITY – EXPLORING THE POTENTIAL OF PUBLIC WELLS IN NOVI SAD 905

Goran Sekulić, Ivana Čipranić

GLOBAL CRISIS IN DRINKING WATER SUPPLY-CASE OF MONTENEGRO: CONTROL OF THE SPECIFIC WATER CONSUMPTION 913

Siniša Višnjik, Krsto Minić

HYDROTECHNICAL PROJECT OF SMALL HYDROPOWER PLANT “MIOLJE POLJE” 919

GEOLOGY, HYDROGEOLOGY AND GEOTECHNICS IN CIVIL ENGINEERING 929

Bojan Arandjelovic, Milivoje Peric, Minja Savic

TESTING METHODOLOGY OF GEOTECHNICAL STRAND ANCHORS 931

Miroslav Bešević, Martina Vojnic Purčar, Milan Gajić, Ljiljana Kozarić, Smilja Živković

DESIGN PROJECT OF THE PROTECTIVE STRUCTURE OF THE FOUNDATION PIT FOR THE CONSTRUCTION IN ROSVELT STREET IN BELGRADE 939

Neđo Đurić, Miroslav Bešević, Dragan Lukić

GEOTECHNICAL CHARACTERISTICS OF THE WORKING ENVIRONMENT OF THE FOUNDATION OF FILTER FACILITY IN THERMAL POWER PLANT UGLJEVIK 1 947

<i>Zoran Đurišić, Slobodan Živaljević</i>	
SOIL COMPACTION CONTROL-CORRELATION BETWEEN METHODS	957
<i>Boško Glušica</i>	
STRUCTURAL DESIGN OF THE FOUNDATION PIT SUPPORT STRUCTURE	965
<i>Primož Jelušič, Stojan Kravanja, Tomaž Žula</i>	
OPTIMAL DESIGN OF GEOSYNTHETIC REINFORCED SOIL BRIDGE ABUTMENT	973
<i>Drago Kotaranin, Teodor Dimitrievski, Kosta Zekmanovski</i>	
GEOTECHNICAL ASPECTS OF REHABILITATION OF STATE ROAD A1, SECTION NEGOTINO- DEMIR KAPIJA	981
<i>Mila Krulanović, Milica Popović, Sergej Poleksić, Nikola Međedović, Marija Matović, Maksim Matović</i>	
METHODOLOGY FOR ENGINEERING GEOLOGICAL MAPPING OF UNSTABLE SLOPES ALONG NIKSIC-PODGORICA RAILWAY LINE	991
<i>Leo Kuljanski</i>	
VARIED APPLICATION OF GEOGRID REINFORCED RETAINING STRUCTURES IN THE FLOOD DEFENCE SYSTEM OF OOIJEN-WANSSUM AREA DEVELOPMENT (THE NETHERLANDS)	999
<i>Borut Macuh, Sašo Kos</i>	
RETAINING STRUCTURE PK-16 AS A PART OF RECONSTRUCTION OF THE G2-108 HRASTNIK - ZIDANI MOST ROAD	1007
<i>Maksim Matović, Milan Radulović, Ana Vojinović, Marina Međedović, Marija Matović</i>	
HYDROGEOLOGICAL INVESTIGATIONS OF THE TARA RIVER ALLUVION FOR WATER SUPPLY OF FACILITIES ALONG THE BAR-BOLJARE HIGHWAY (SECTION SMOKOVAC-UVAČ-MATEŠEVO)	1015
<i>Borko Miladinović, Slobodan Živaljević</i>	
DETERMINING SEISMIC LATERAL EARTH PRESSURE ON THE RC RETAINING STRUCTURE WITH CANTELIVER AND COMPLETELY EARTH-EMBEDDED ELEMENTS	1023
<i>Marko Pavlović, Marina Dojčinović, Anja Terzić, Irena Grigorova, Ljubiša Andrić</i>	
CAVITATION EROSION RESISTANCE OF BASALT	1031
<i>Zlatko Zafirovski, Slobodan Ognjenovic, Vasko Gacevski, Ivo Velickovski, Viktor Jonceski</i>	
APPLICATION OF REINFORCED EARTH IN ROADS SUBSTRUCTURE	1039
SURVEYING/GEODESY IN CIVIL ENGINEERING	1047
<i>Radovan Đurović, Gojko R. Nikolić, Zoran Sušić, Mirko Borisov</i>	
ROLE OF GEODESY AND CARTOGRAPHY IN THE MAKING OF SPATIAL PLANNING DOCUMENTS IN THE CONTEXT OF THE NEW SPATIAL PLAN OF MONTENEGRO (PPCG 2020-2035)	1049

Tanja Fržović, Sanja Tucikešić, Branko Božić

**GEODETIC DEFORMATION MONITORING OF THE FACTORY FACILITY
FOR WASTE WATER TREATMENT 1059**

Anastasija Martinenko

**MONITORING ACTIVE LANDSLIDE AT UMKA SETTLEMENT USING UAV
PHOTOGRAMMETRY 1067**

Slobodan Pandžić, Slavoljub Tomić, Jelena Pandžić

**ACCURACY OF VOLUME CALCULATION OF DEPOSITED BUILDING
MATERIAL IN TERMS OF POINT NUMBER REDUCTION 1075**

*Biljana Stamatović, Vladimir Bulatović, Zoran Sušić, Ivan Aleksić, Gojko Nikolić,
Kruna Ratković, Marko Simeunović*

EUREF NETWORK – STANDARDS AND CONNECTION PROCEDURE 1083

MANAGEMENT IN CIVIL ENGINEERING 1091

Rašid Hadžović, Osman Tibo, Ermin Budim

STATIC – ECONOMIC ANALYSIS OF PREFABRICATED GIRDERS 1093

Mimica Milošević, Dušan Milošević, Ana Stanojević, Dragan Stević, Branko AJ Turnšek

**AHP-TOPSIS OPTIMIZATION OF SUSTAINABLE CONSTRUCTION
PROJECTS 1101**

Domingos Ribas, António Curado, Paulo Cachim

**ECONOMICAL SUSTAINABILITY ASSESSMENT FOR A SET OF FAÇADE
WALLS – COMPARATIVE ANALYSIS 1109**

Jovana Topalić Marković, Vladimir Mučenski

**ESTABLISHING THE DELPHI TEAM IN THE RESEARCH OF THE RISK
ASSESSMENT MODEL FOR BUILDING OF WASTEWATER TREATMENT
PLANTS 1117**

Dragan Žarković, Stefanela Žarković

**CORPORATE MANAGEMENT OF INVESTMENT ENTERPRISE IN
CONSTRUCTION, IN THE FUNCTION OF QUALITY AND SUSTAINABLE
DEVELOPMENT 1125**

INFORMATICS AND MULTIMEDIA TECHNOLOGY IN CIVIL ENGINEERING 1133

Sofija Kekez

A NEW APPROACH IN DESIGN OF SELF-SENSING MATERIALS 1135

Dragan Stević, Dušan Milošević, Mimica Milošević

**THE DATA EXTRACTION WITH FUZZY C MEANS ALGORITHM ON
LANDSAT 7 SATELLITE IMAGERY 1143**

Merima Šahinagić – Isović, Marko Čećez, Mladen Radivojević

**MORE EFFECTIVE MONITORING OF CONSTRUCTION JOBS, AND
PROVIDING COMPETITIVE ADVANTAGE WITH THE USE OF DRONES 1151**

EDUCATION IN CIVIL ENGINEERING 1159

Snežana Rutešić, Ivana Čipranić, Marija Jevrić

**THE ACADEMIC ACHIEVEMENT ANALYSIS OF STUDENTS GRADUATED
WITH A BACHELOR'S DEGREE IN CIVIL ENGINEERING 1161**

*Biljana Šćepanović, Luisa María Gil Martín, Enrique Hernández Montes, Olga Mijušković,
Ljiljana Žugić*

**INSTITUTIONAL SUPPORT FOR WRLT ACTIVITIES OF UNIVERSITY
STAFF 1171**

GNP 2020 AUTHORS 1179

Foundation Professor Arsenije Vujović - COMPETITION 1215

CO-ORGANIZER 1219

SPONSORS 1227